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PATENT APPLICATION TRANSMITTAL LETTER
(Large Entity)

Docket No.
2107 (FJ-98-4)

TO THE ASSISTANT COMMISSIONER FOR PATENTS

Transmitted herewith for filing under 35 U.S.C. 111 and 37 C.F.R. 1.53 is the patent application of:

EDYNN SCHULZ

For: **APPARATUS AND METHODOLOGY FOR EMBOSsing FIBROUS WEBS CONTAINING CONTAMINANTS**

(This appln. claims the benefit of the filing date of U.S. Provisional Appln. No. 159,761, filed 10/15/99)

Enclosed are:

Certificate of Mailing with Express Mail Mailing Label No. EK074027425US
 ONE (1) FORMAL sheets of drawings.
 A certified copy of a application.
 Declaration Signed. Unsigned.
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 Information Disclosure Statement
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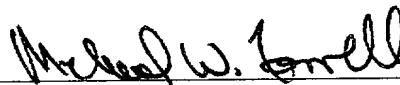
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CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	16	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	4	- 3 =	1	x \$80.00	\$80.00
Multiple Dependent Claims (check if applicable)	<input type="checkbox"/>				\$0.00
				BASIC FEE	\$710.00
				TOTAL FILING FEE	\$790.00

A check in the amount of to cover the filing fee is enclosed.
 The Commissioner is hereby authorized to charge and credit Deposit Account No. 50-0935 as described below. A duplicate copy of this sheet is enclosed.
 Charge the amount of \$790.00 as filing fee.
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 Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: October 11, 2000


Signature

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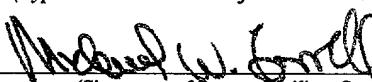
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CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)Applicant(s): **GALYN A. SCHULZ**

Docket No.

2107 (FJ-98-4)Serial No.
UNKNOWNFiling Date
HEREWITHExaminer
UNKNOWNGroup Art Unit
UNKNOWNInvention: **APPARATUS AND METHODOLOGY FOR EMBOSsing FIBROUS WEBS CONTAINING
CONTAMINANTS**

1C825 U.S.P.T.O.
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I hereby certify that this New Pat. Appln. Decl., Assignment w/Cover Sheet & Return Postal Card
*(Identify type of correspondence)*is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under
37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on
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*(Date)***Michael W. Ferrell***(Typed or Printed Name of Person Mailing Correspondence)**(Signature of Person Mailing Correspondence)***EK074027425US***("Express Mail" Mailing Label Number)*

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Attorney's Docket No. 2107 (FJ-98-4)

Non-Provisional Patent Application of:

Galyn A. Schulz

For:

Apparatus and Methodology for Embossing Fibrous Webs Containing Contaminants

APPARATUS AND METHODOLOGY FOR EMBOSsing FIBROUS WEBS
CONTAINING CONTAMINANTS

5 Cross-Reference to Related Applications

This application claims the benefit of the filing date of U.S. Provisional Patent Application Serial No. 60/159,761, filed October 15, 1999.

Technical Field

10 The invention relates to embossing of paper products, for example, paper towels, toilet tissue and napkins, in which an improved embossing combination is used which is particularly suitable for the embossing of paper products made from recycled pulp.

15 Background of the Invention

Paper products, such as paper towels, napkins and toilet tissue are widely used on a daily basis for a variety of household needs. Typically, such products are formed of a fibrous elongated web which is either packaged in rolls or in a folded stack. The fibrous webs are usually embossed to increase the bulk of the tissue and to improve the absorbency, softness and appearance of the product both as individual sheets, and in providing a uniform stack or roll package. Embossing can also aid in holding superposed plies of a web together. A commonly used embossing apparatus includes one or more steel embossing rollers having male protuberances thereon for forming the embossed pattern, and a corresponding steel roller which includes matched or mated female recesses which are a three dimensional mirror image of the male protuberances. The web passes between the nip (gap) of the male and female embossing rollers such that the embossed pattern is imparted to the web.

Recently, environmental concerns have led to the use of greater amounts of recycled pulp in the production of paper products. However the economies of recycling make it practically impossible to remove all contaminants from the recycled pulp. In particular, recycled pulp often contains contaminants such as particles of glue and small pieces of plastic which adhere to the pulp, and which are known as "stickies". These contaminants when passed through the embossing rollers of paper production equipment may adhere to, or become lodged in, the protuberances or recesses of the rollers causing excess wear and possible damage to the embossing rollers, thus negating the savings had from the use of recycled materials. If on the other hand, the clearances embossing machinery are adjusted to accommodate possible contaminants in the recycled pulp, the qualities of the finished paper product may be adversely affected, which will render such recycled pulp based products less commercially attractive.

15 The present invention is directed to apparatus and methodology to provide embossing of recycled pulp without adversely affecting the processing machinery. This enables the recycled pulp to be embossed in a manner similar to that of non-recycled pulp which provides an absorbency, softness and appearance to the finished product which compares favorably to paper products made from non-recycled pulp. It
20 has been found that recycled pulp can be embossed in a manner comparable to that of non-recycled pulp, even if it contains contaminants, if the embossing is carried out by matched embossing rollers in which one of the rollers is relatively soft Shore A (durometer) hardness of 40-65 and the other roller is relatively hard Shore A (durometer) hardness above about 90. The hard roll of the matched set may be a steel
25 roll which is "off" of the Shore A hardness scale. As used herein, the terminology having a Shore A hardness of at least about 90 and the like or "greater than about 90" includes harder surfaces such as steel surfaces whether or not a different hardness scale would be applicable. As one of skill in the art will appreciate, a P&J hardness

scale is applicable to steel surfaces. Recycled pulp, even containing contaminants, may be embossed in this manner without causing excess wear or damage to the embossing rollers.

5 As used herein a matched set of embossing rollers means that the male embossing elements, carried by one roller, are engraved first and the female elements carried by the other rollers are subsequently made from the male elements, or vice versa, so that both elements are virtually inverse or reciprocal images of each other within the practicalities of manufacturing tolerances. This is in contrast to
10 “unmatched” embossing rollers in which the male and female embossing elements are not identical in shape, but still are positioned relative to each other in registry such that they engage.

15 It is an object of the present invention to provide apparatus and methodology for embossing webs that will avoid damage to the processing machinery should the web contain contaminating particles.

20 It is an object of the present invention to provide apparatus and methodology for embossing paper products that will permit processing of recycled pulp without causing excess wear or damage to the processing machinery.

25 It is an object of the present invention to provide apparatus and methodology for embossing paper products that will permit older embossing machinery having matched embossing rollers to be retrofitted with a matched roller that can accommodate pulp that may contain contaminants, such as recycled pulp.

Background Art

U.S. Patent Nos. 5,503,896 and 5,529,563, both to *Veith et al.*, disclose methods for embossing webs using unmatched male and female embossing elements which are preferably made by laser engraving rubber embossing rolls (see, e.g., col. 5, lines 49-52 of U.S. Patent No. 5,503,896). The male and female embossing elements can be made of different materials. For example, the male elements can be made of steel, and the female elements can be composed of a deformable material, such as rubber, or vice versa (see, e.g., col. 4, lines 3-5 of U.S. Patent No. 5,503,896). The web can be any web suitable for embossing, including paper, tissue, nonwovens, 10 films, laminates, combinations thereof and the like (see, e.g., col. 4, lines 10-13 of U.S. Patent No. 5,503,896).

U.S. Patent No. 5,727,458 to *Schulz* (the inventor herein) discloses an embossing method wherein two plies of web material are multilevel embossed 15 between rigid engraved embossing rolls and backup embossing rolls. The backup embossing rolls can be composed of laser engraved rubber (see, e.g., col. 3, line 64 and col. 4, lines 56-57 and 67). The non-backup embossing rolls are generally composed of steel but may be substituted with laser-engraved rubber rolls (col. 4, lines 16-21). The backup embossing rolls may have a mirror image engraving of the 20 embossing pattern on the non-backup embossing rolls (col. 4, lines 64-66). The embossing method can be used to make toilet tissue and paper towels (col. 3, lines 53-54).

United States Patent No. 5,269,983 to *Schulz* (the inventor herein) describes a 25 method of embossing involving a mated pair of resilient and rigid embossing rolls. According to the '983 patent a laser can be utilized to form recesses in a resilient roll such that the resilient roll receives protuberances of a rigid male embossing roll when the rolls are placed in contact.

Brief Description of the Drawings

For a better understanding of the invention reference is made to the following drawings which are to be taken in conjunction with the detailed description to follow:

5 **FIGURE 1** is a side view of a paper product embossing apparatus in accordance with the present invention.

Figures 2a and 2b illustrate the nip between the processing rollers with **Figure 2a** showing the embossing of a portion of a web that is free of contaminating particles and **Figure 2b** showing the embossing of a portion of a web that includes a contaminating particle.

Description of the Preferred Embodiments

Figure 1 illustrates the embossing apparatus 10 of the present invention which includes a pair of supply rolls 12, 14 which supply the fibrous web to be embossed. While a pair of supply rolls is shown, to form a two-ply web 16, it is to be understood that multiple supply rolls may be provided for any desired number of plies or a single roll may be utilized to provide a single ply web or a multi-ply web in which the plies have been previously joined. A first embossing roller 18 is provided which has a “hard” outer surface having a plurality of protuberances 20 corresponding to the desired embossing pattern. The protuberances 20 are shown representatively, and may take any desired form, shape or number in accordance with the present invention. A second “soft” embossing roller 22 is provided having a deformable outer surface with female portions or recesses 24 provided which are matched to the embossing pattern of the protuberances 20, such that as the rolls 18,22 are in rolling engagement, the protuberances 20 of the rigid roll enter the recesses 24 of the resilient roll. The hard and soft rolls thus cooperate to form the embossed pattern on the web. A hydraulic system may be provided as shown schematically by blocks 26,28 to allow for

separation of the rolls, for example, to allow initial feeding and registration of the web between the rolls, and to urge the rolls together for the embossing operation. A nip **30** is formed between rollers **18,22** and can be adjusted by the hydraulic systems **26,28**. Web **16** after being embossed, may then proceed to further web processing machinery such as a perforation roller **32**.

In accordance with the present invention it has been found that if one of the matched pair of embossing rollers is formed from material that is less hard than the material of the other embossing roller, webs containing contaminants can be embossed without excess wear or damage to the embossing rollers. Specifically, the “hard” roller should have a Shore A hardness greater than about 95 (including steel), preferably 95-99 for laser engraved rolls. The “soft” roller should have a Shore A hardness of 40-95 and preferably in some embodiments 40-85 or 40-75 or even more preferably 40-65. The particular material used for either roller is not critical, for example, the hard roller could be steel, or a hard rubber or plastic. The soft roller is preferably natural rubber but can also be synthetic rubber or plastic. A Shore A hardness of 60-65 is particularly useful in some embodiments. A natural rubber can readily be made into a mirror image of the other roller by a laser process to “read” the protuberances or recesses and “burning” away the rubber. Such a process is described in United States Patent No. 5,269,983 issued to *Schulz* (the inventor herein), the disclosure of which is hereby incorporated by reference as if fully set forth herein.

In a particularly preferred method of the invention, there is provided a method for embossing a fibrous web containing contaminants to improve the bulk and softness of the web by passing the web through a nip formed by a pair of rotating rollers, wherein the contaminants will not damage the rollers, the method comprising the steps of a) providing a first embossing roller having an outer surface, said outer surface having a plurality of male protuberances thereon corresponding to a desired

embossed pattern; b) providing a second embossing roll having an outer surface having a plurality of female recessed portions which are matched to the male protuberances of the first roll; c) wherein at least one of said first and second embossing rollers is a laser engraved roller and has a Shore A hardness from about 5 40-95; and d) placing the rolls in contact to form a nip between the rolls, with the protuberances of the first roll entering the recesses of the second roll as the rolls rotate together; and passing a fibrous web through the nip formed by the rolls to emboss the web wherein the roller having the Shore A hardness of 40 will deform if any contaminants are encountered in the fibrous web. More typically, at least one 10 roller will have a Shore A hardness of from 40-85 or 40-75 with perhaps a Shore A hardness of from 40-65 being particularly preferred.

15 **Figures 2a and 2b** illustrate nip **30** between rollers **18, 22** as they act on web **16**. In **Figure 2a** the portion of web shown **16** is free of any contaminants, it is seen than web **16** is embossed between the protuberances **20** of roller **18** and the recesses of roller **24** as web **16** is deflected therebetween, with the gap “**a**” defined as the distance between rollers **18, 22**. In **Figure 2b** the portion of web shown **16** includes a contaminating particle **40**, such as a particle of glue or plastic, it is seen that web **16** is again deflected between the protuberances **20** of roller **18** and the recesses of roller **24**, however particle **40**, which may be non-compressible, will also be lodged between protuberance **20** and recess **24**. However, as roller **22** is formed from 20 deformable material a temporary recess **42** will be formed in recess **24** of roller **22** which permits particle **40** to pass without damaging rollers **18, 22**. If both rollers were formed from harder material contaminants would easily damage, or become lodged 25 in, the rollers.

From the point of view of the operation of the present invention it is irrelevant

whether the soft roller is the male roller (having the protuberances) or the female roller (containing the recesses). However from a practical viewpoint, it is likely to be less expensive to manufacture the female roller from rubber as this will generally require the removal of less material in the laser engraving process. The present

5 invention may be easily implemented on older embossing equipment as the only change required is the replacement of one of the rollers in each embossing pair. The embossing roller's drive equipment, roller diameters and lengths as well as spacing will all remain unchanged. Furthermore, the size and type of the individual embossing elements are not limited by the present invention as both microembossing and

10 macroembossing of fibrous webs can be undertaken.

The present invention is applicable as well to the updating of older embossing machinery having matched steel rollers. One of each of the matched pair of rollers can be removed, and by the laser reading and burning process described above, a new

15 soft roller can be created to match the steel roller which may then be installed in the embossing equipment. In this manner older equipment otherwise unsuitable for the embossing of recycled material can be utilized to carry out the present invention thus extending the useful life of the equipment.

20 The present invention is also applicable to embossing machinery using unmatched rollers in which one of the rollers is replaced by a soft roller having the hardness parameters set forth above. Finally, the use of two matched soft rollers having a Shore A (durometer) hardness of 40-65 and a Shore A hardness of 60 and preferably of about 80 could also be used to emboss recycled pulp without damage

25 from contaminants in accordance with the present invention.

The invention has been described with respect to preferred embodiments. However, as those skilled in the art will recognize, modifications and variations in the

specific details which have been described and illustrated may be resorted to without departing from the spirit and scope of the invention as defined in the appended claims.

RECORDED MAIL

WHAT IS CLAIMED IS:

1. A method for embossing a fibrous web containing contaminants to improve the bulk and softness of the web by passing the web through a nip formed by a pair of rotating rollers, wherein the contaminants will not damage the rollers, the method comprising:

5 a) providing a first embossing roller having an outer surface, said outer surface having a plurality of male protuberances thereon corresponding to a desired embossed pattern;

10 b) providing a second embossing roll having an outer surface having a plurality of female recessed portions which are matched to the male protuberances of the first roll;

15 c) wherein one of said first and second embossing rollers has a Shore A hardness of 40-65 and the other roller has a Shore A hardness of at least about 90; and

20 d) placing the rolls in contact to form a nip between the rolls, with the protuberances of the first roll entering the recesses of the second roll as the rolls rotate together; and passing a fibrous web through the nip formed by the rolls to emboss the web wherein the roller having the Shore A hardness of 40-65 will deform if any contaminants are encountered in the fibrous web.

25

2. The method of claim 1, wherein the step of providing a second roller includes utilizing a laser to form the recesses in the second roll, by removing portions

of the material from the outer surface.

3. The method of claim 1, wherein the roller having a Shore A hardness of 40-65 comprises material selected from the group consisting of natural rubber, 5 synthetic rubber and plastic.

4. The method of claim 1, wherein the roller having a Shore A hardness of at least about 90 is constructed of steel.

10 5. Apparatus for embossing a fibrous web containing contaminants so that the contaminants will not damage the rollers, comprising:

15 a) a first rotating embossing roller having an outer surface, said outer surface having a plurality of male protuberances thereon corresponding to a desired embossed pattern;

20 b) a second rotating embossing roller having an outer surface having a plurality of female recessed portions which are matched to the male protuberances of the first roller;

25 c) wherein one of said first and second embossing rollers have differing hardnesses; and

d) wherein the first and second rollers are disposed to form a nip between the rolls, with the protuberances of the first roll entering the recesses of the second roll as the rolls rotate together; to permit the fibrous web thermoplastic through the nip formed by the rollers, wherein the roller having the lesser hardness will deform upon contact with a

contaminant in the fibrous web.

6. The apparatus as claimed in claim 5 wherein one of said first and second embossing rollers has a Shore hardness of 40-65 and the other roller has a Shore A hardness of at least about 95.
5
7. The apparatus as claimed in claim 6 wherein the roller having a Shore A hardness of at least about 95 is constructed of steel.
10
8. The apparatus as claimed in claim 6 wherein the roller having a Shore A hardness of 40-65 comprises material selected from the group consisting of natural rubber, synthetic rubber and plastic.
15
9. The apparatus as claimed in claim 5 wherein one of said first and second embossing rollers has a Shore A hardness of about 60-65.
15
10. A method to update paper embossing machinery having matched pairs of embossing rollers to enable the machinery to accommodate pulp that may contain contaminants, comprising the steps of:
20
- a) providing a embossing roller comprising material having a Shore A hardness of 40-65;
- b) utilizing one of each pair of embossing rollers to produce a matched opposite roller from the embossing roller of material having a Shore A hardness of 40-65; and
25
- c) replacing one of each matched pair of embossing rollers with the roller

produced from material having a Shore A hardness of 40-65.

11. The method of claim 10, wherein the step of producing a matched roller includes utilizing a laser to removing portions of the material from the outer surface of the roller produced from material having a Shore A hardness of 40-65.

12. The method of claim 10, wherein the roller having a Shore A hardness of 40-65 comprises material selected from the group consisting of natural rubber, synthetic rubber and plastic.

13. A method for embossing a fibrous web containing contaminants to improve the bulk and softness of the web by passing the web through a nip formed by a pair of rotating rollers, wherein the contaminants will not damage the rollers, the method comprising:

a) providing a first embossing roller having an outer surface, said outer surface having a plurality of male protuberances thereon corresponding to a desired embossed pattern;

b) providing a second embossing roll having an outer surface having a plurality of female recessed portions which are matched to the male protuberances of the first roll;

c) wherein at least one of said first and second embossing rollers is a laser engraved roller and has a Shore A hardness of from about 40 to about 95; and

ABSTRACT

Apparatus and methodology to provide embossing of recycled pulp, which
5 may contain contaminants such as glue or paper particles, without adversely affecting
the processing machinery. This enables the recycled pulp to be embossed in a manner
similar to that of non-recycled pulp which provides an absorbency, softness and
appearance to the finished product which compares favorably to paper products made
from non-recycled pulp. The embossing is carried out by matched embossing rollers
10 in which one of the rollers is relatively soft (Shore A hardness of 50-65) and the other
roller is relatively hard (Shore A hardness above 90). Recycled pulp, even containing
contaminants, may be embossed in this manner without causing excess wear or
possible damage to the embossing rollers.

the *Journal of the Royal Society of Medicine* (1960, 53, 101-102) and the *Journal of Clinical Pathology* (1960, 14, 101-102).

FIG. 1

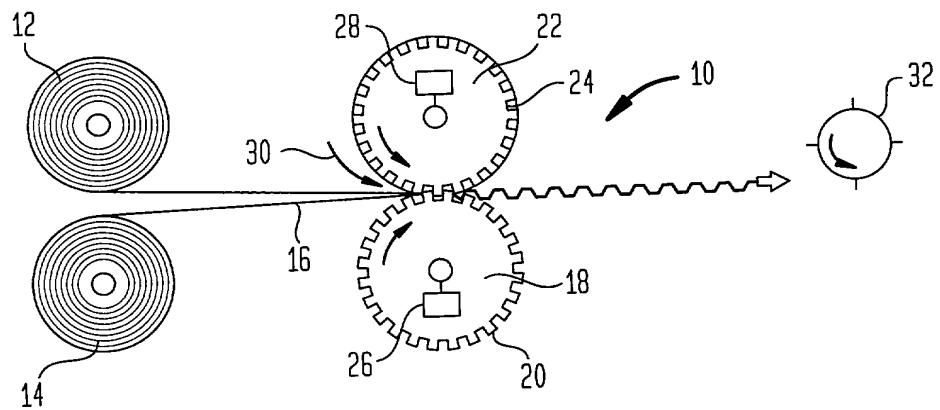


FIG. 2A

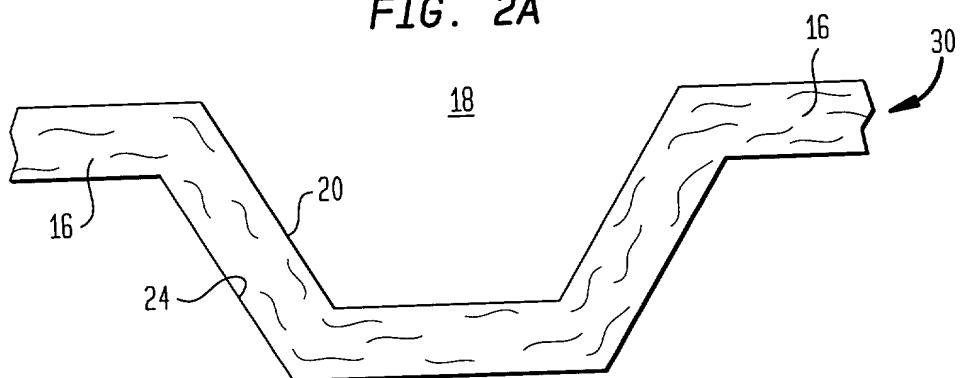
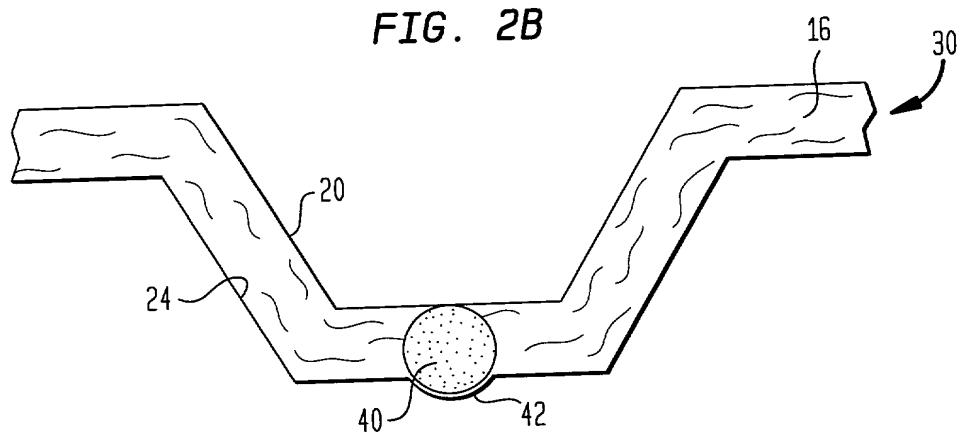


FIG. 2B



Docket No.
2107 (FJ-98-4)

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

APPARATUS AND METHODOLOGY FOR EMBOSsing FIBROUS WEBS CONTAINING CONTAMINANTS

the specification of which

(check one)

is attached hereto.

was filed on _____ as United States Application No. or PCT International Application Number _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed _____

(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

60/159,761	October 15, 1999
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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Full name of second inventor, if any	
Second inventor's signature	Date
Residence	
Citizenship	
Post Office Address	